Title: Mystery Mural -- A Visual Display for Interdisciplinary Projects

Link to Outcomes:

- **Problem Solving** Students will use appropriate technology to solve problems in a cooperative atmosphere.

- **Communication** Students will communicate mathematical concepts verbally and in written form.

- **Reasoning** Students will make conjectures and reason mathematically.

- **Connections** Students will demonstrate their ability to connect mathematics with real-life applications.

- **Estimation** Students will demonstrate their ability to estimate size using metric units.

- **Measurement** Students will demonstrate their ability to apply concepts of measurement using scale drawings and metric units.

- **Relationships** Students will demonstrate their ability to apply concepts of coordinate graphing.

Brief Overview:

Constructing a mural is a way for students to display what they have learned in any interdisciplinary project. While cooperatively involved in the construction, students will apply mathematical skills such as using metric measurement, using ratio and proportion to make scale drawings, and coordinate graphing.

Grade/Level:

Middle School grades 6-8

Duration/Length:

This lesson will take 3 class periods.

Prerequisite Knowledge:

Students will need a basic understanding of the following:

- Ratio and proportion
- Scale drawing
- Coordinate graphing

Objectives:

The students will be able to:

- locate an object on a coordinate grid.
- reduce or enlarge a picture by using coordinates.
- estimate the dimensions of objects in centimeters.
- reduce dimensions using a scale.
- work in cooperative groups.
- use math skills to complete an interdisciplinary project.

Materials/Resources/Printed Materials:

Each student will need:

- 1 sheet of 8 1/2" by 11" paper
- 1 sheet of 8 1/2" by 11" grid paper

Each cooperative group will need:

- 1 sheet of 45cm by 60cm grid paper
- 1 sheet of 90cm by 120cm grid paper
- calculator
- metric ruler
- markers

Development/Procedures:

Day 1:

- Assign each student a partner. Provide each student with a blank piece of paper. Have one student draw a rectangle on the blank piece of paper, verbally describe the location of the rectangle to the partner and ask the partner to duplicate the rectangle on his/her paper based on the description. Compare the locations of the two rectangles.

- Give each student a coordinate grid and repeat the above procedure.

- Compare the advantages and disadvantages of these two methods of describing the location of a rectangle.

- Assess and/or reinforce previous knowledge using these activities:

   Play battleship.

   Complete worksheet #1 on which students locate given ordered pairs to create a design.

   Create an isosceles triangle by giving students two vertices and asking them to name a third.

   Find the coordinates of the endpoint of a line segment when given the coordinates of the midpoint and one endpoint.

Research Rene Descartes and other mathematicians who contributed to the development of graphing.

- Make an enlargement and/or reduction of a drawing by following this procedure:

  Divide a simple design into equal squares. Label the top of each square as part of a one-quadrant grid. Cut out the squares.

  Give each student a square section of this simple design.

  Have each student copy his/her section of the drawing onto a blank square of larger or smaller paper.

  Have each student put the enlarged or reduced square of paper on the chalkboard in order using the coordinates from the original square.

  Compare the new enlarged or reduced design to the original design.

- Collect examples of scaled objects, such as; model cars, blueprints, etc.

- Have each student write a journal entry in sentence form stating real-life situations when scale drawings are needed.

Day 2:

- Review the lesson from Day #1 by reading and discussing the students' journal entries which listed uses of scale drawings.

- Assign students to a cooperative group. Match common objects to their estimated height in centimeters.

  The following is a suggested list.

OBJECT	ESTIMATED HEIGHT
tall tree	750 cm
house	600 cm
puppy	30 cm
adult	180 cm
middle-schooler	100 cm

- Reduce the size of the listed objects using a scale of 1 cm : 15 cm.

OBJECT	ESTIMATED HEIGHT	REDUCED HEIGHT
tall tree	750 cm	50 cm
house	600 cm	40 cm
puppy	30 cm	2 cm
adult	180 cm	12 cm
middle-schooler	100 cm	7 cm

- Have each cooperative group complete these steps:

  Read the story problem sheet.
  Discuss the procedures.
  Gather the needed materials.
  Follow the steps on the story problem sheet.

- Have each student write a journal entry in paragraph form summarizing this task.

Day 3:

- Complete the mystery mural by combining the scenes from all of the cooperative groups.

- Evaluate the mural by discussing the following:

  Does the completed mural summarize the important scenes from the novel?

  Does the completed mural depict objects in a reasonable proportion?

- Have each student complete the journal entry from Day #2.
  Share the journal entry with his/her parents.

- Display the completed mural in the hall.

Evaluation:

A group assessment will be made as the class discusses the completed mural.

An individual assessment will be made at the conclusion of these lessons when each student writes a journal entry describing the task and completes worksheet #2- Making a birdhouse.

Extension/Follow Up:

The students could construct 3-dimensional displays in the form of life-size models or dioramas.

The students could use 4-quadrant graphing to complete a mural.

Using a graphing calculator, the students could enter x and y values into a table and predict what the graph would look like.

The students could check to see if fractions are equivalent by plotting the numerator and denominator as coordinates on a graph. Equivalent fractions will form a straight line.
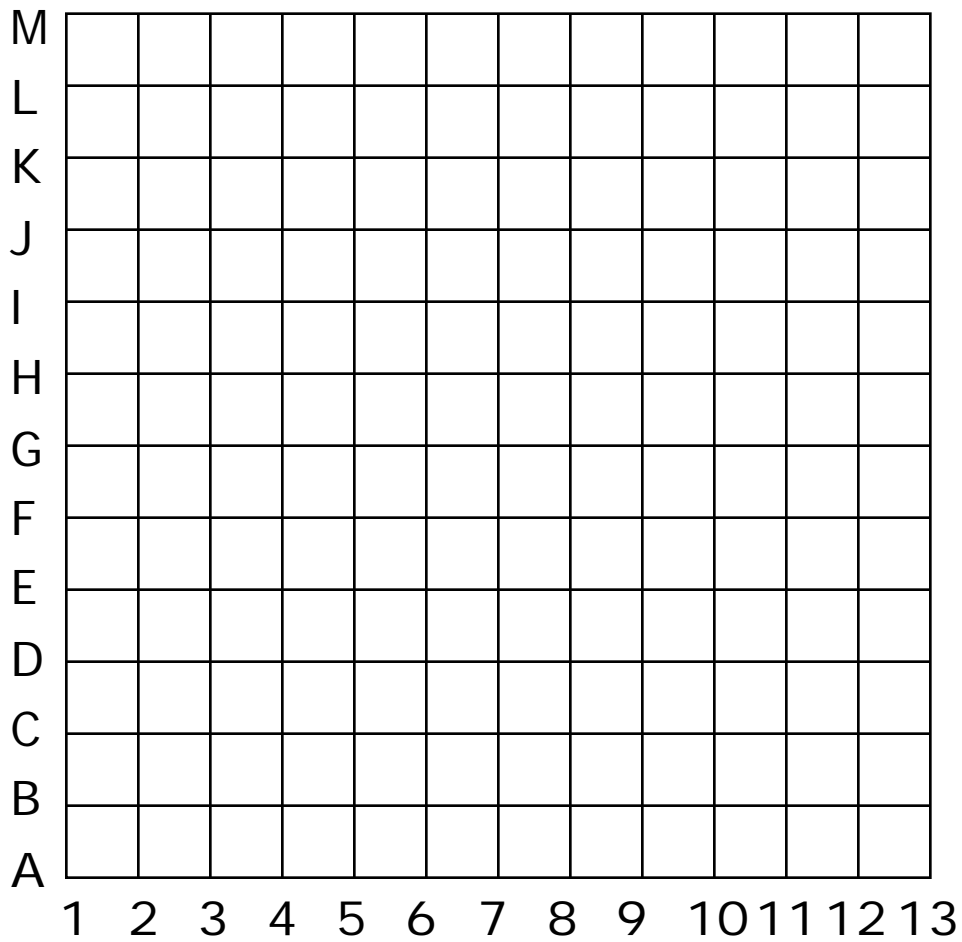
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Worksheet #1
Coordinate Grid

M
L
K
J
I
H
G
F
E
D
C
B
A

1 2 3 4 5 6 7 8 9 10 11 12 13

Plot and label the following points on the one-quadrant graph. Then, starting with the first column, connect the points in order to make a picture.

L,7	E,7
H,5	B,11
H,2	F,9
F,5	H,12
B,3	H,9

Part I.   Draw and label each part of a birdhouse using the description below.

1. The base measures 20cm by 30cm.

2. The left and right sides are 30cm and 22cm tall.

3. The front and the back are pentagons with right angles at the base. They are 20 cm along the bottom, 22 cm tall on the left and the right, and 30 cm tall in the middle at the peak of the roof.

4. The roof is made of two rectangles, each 12 cm by 30 cm.

Part II.   Reduce or enlarge the size of your birdhouse. Begin by choosing a metric scale. Label each part of your birdhouse as you did in your original drawing. Do not include the scale on your drawing.   When completed, share this drawing with another student who will check the accuracy of your drawing and determine the scale.

STORY PROBLEM
MYSTERY MURAL

Your class has been selected to create a hall mural to illustrate your favorite scenes from the novel you've just completed in language arts. Your cooperative group will be assigned one scene from the novel. Your 90 cm by 120 cm scene will be illustrated on part of a grid. Your scene combined with the scenes from the other cooperative groups will form a large grid mural. This mural will be a mystery until all the scenes have been combined.

- Think about the items from your scene in the novel that you would like to include in your drawing.
- Discuss and estimate their dimensions in centimeters.
- Think about the placement of these items in your scene.
- Discuss the role of perspective in your drawing.

Now your group is ready to create your scene. You will be given grid paper measuring 45 cm by 60 cm for your rough draft. Use the scale 1 cm : 15 cm. Later you will be given a section of the mystery mural on which to transfer your drawing.

Complete each task:

- Make a chart of the objects that you would like to include in your scene and their estimated dimensions.

- Use a calculator to reduce your estimated dimensions using a scale of 1cm : 15 cm.

- Draw the selected objects on your grid paper using the reduced dimensions from the chart and perspective.

- Transfer your rough draft to your section of the larger mystery mural using coordinates.

- Color and decorate your section of the mystery mural.